

Best Practices in Green Infrastructure Asset Management Planning

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Toronto and Region
Conservation
Authority

 **Green** infrastructure
ONTARIO COALITION

Workshop Agenda

1. Introduction to green infrastructure (10 minutes)
2. State of Infrastructure (15 minutes)
3. Levels of Service (10 minutes)
4. Lifecycle Management & Financial Strategy (10 minutes)
5. Green Infrastructure Asset Management Maturity Spectrum (10 minutes)
6. Conclusions (5 minute)

How would you rate your current level of knowledge about green infrastructure?

To what extent has your municipality integrated green infrastructure into their asset management planning process?

Green Infrastructure Types

Urban Tree
Canopy

Parks and Public
Spaces

Natural
Heritage

Stormwater
Systems

Green
Roofs/Walls

Urban
Agriculture

Green
Technologies

Soils



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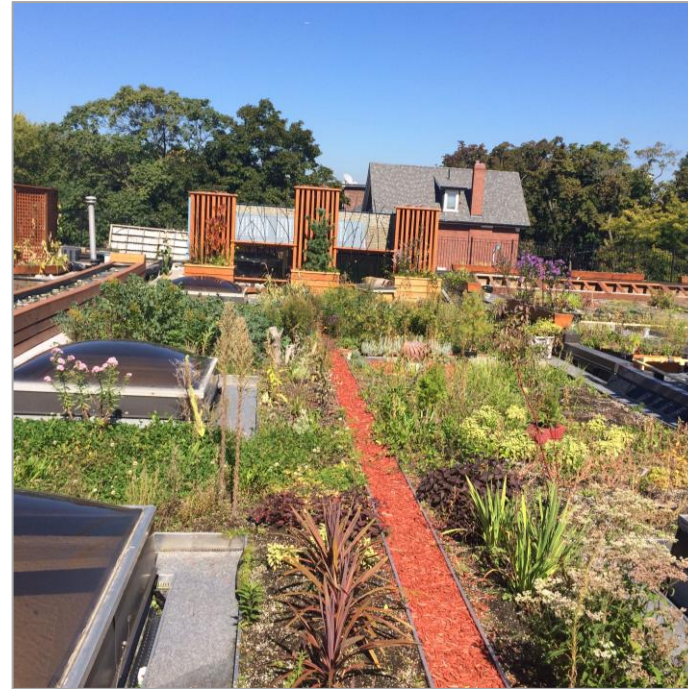
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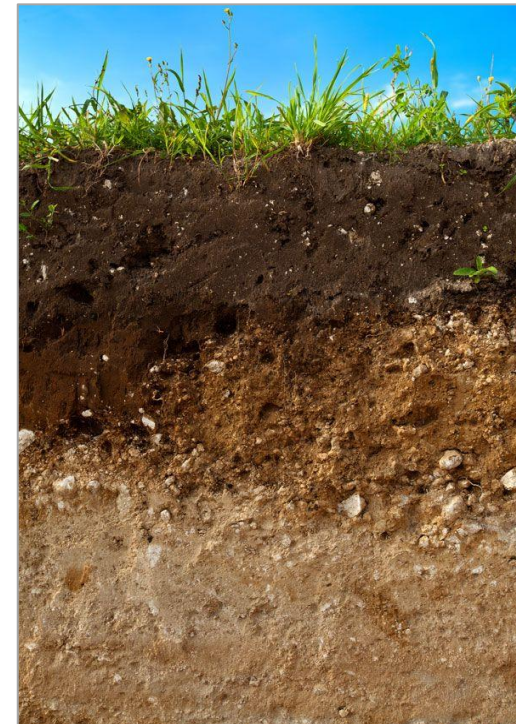
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Green Infrastructure

Natural



Engineered



Combined



Municipal Green Infrastructure Assets

		Green Infrastructure Focus Areas				
		Urban Forest	Storm water	Parks & open space	Agriculture & urban agriculture	Green roofs & walls
Asset Category	Natural	Forest/Woodlot	Natural wetland	Meadow	Agricultural land	n/a
		Park tree	Natural watercourse	Ravines/valley land	Soil	
		Street tree	Lake/pond	Natural open space		
		Soil	Soil	Soil		
	Enhanced	Engineered soil	Constructed wetland	Trails	Community garden	Green roof garden
		Soil cell	Bioswale	Park land		Green roof
			Dry/wet pond			Green wall
			Rain Garden			
	Engineered	n/a	Permeable paving	Sports field	n/a	n/a
			Infiltration trenches/chambers	Playground		
			Rain barrels			

Green Infrastructure Definitions

Ontario Provincial Policy Statement

Natural and human-made elements that provide ecological and hydrological benefits. Green infrastructure can include components such as natural heritage features and systems, parklands, storm water management systems, urban forests, permeable surfaces, and green roofs.

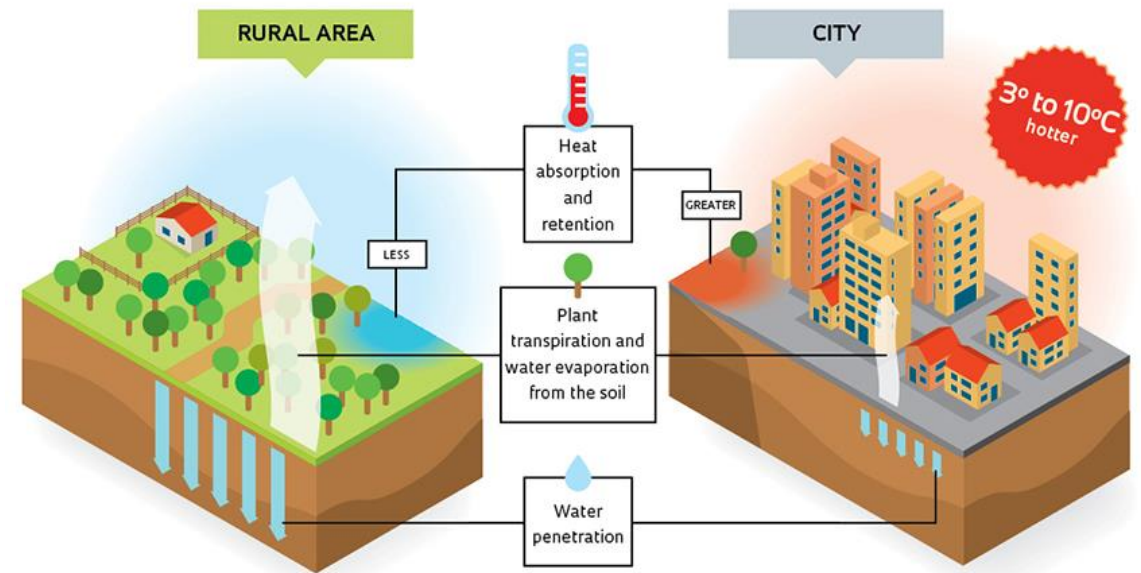
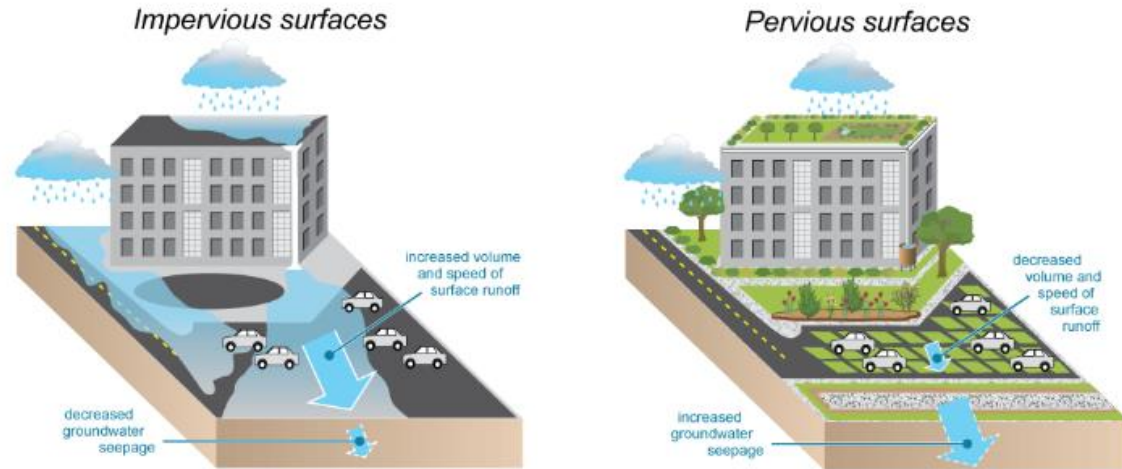


Federal Green Infrastructure Stream

Support the reduction of greenhouse gas emissions, enable greater adaptation and resilience to the impacts of extreme weather and disaster mitigation. It also helps ensure communities can provide clean air and safe drinking water for everyone.



Stormwater Management & Urban Heat



Climate Change Adaptation & Mitigation



Many Services

- Increased biodiversity
- Improved air quality
- Aesthetics
- Oxygen production
- Mental health



Which assets does your municipality own or manage?



Individual Trees



Parks and Open Space



Stormwater Systems / LID



Natural Areas
(Forests, Wetlands)



Green Roofs or
Urban Agriculture

Asset Management Planning in Ontario

Asset Management Planning for Municipal Infrastructure Regulation, O. Reg. 588/17 (January 2018)

5. (1) Every municipality shall prepare an asset management plan in respect of its core municipal infrastructure assets by July 1, 2021, and in respect of **all of its other municipal infrastructure assets by July 1, 2023.**

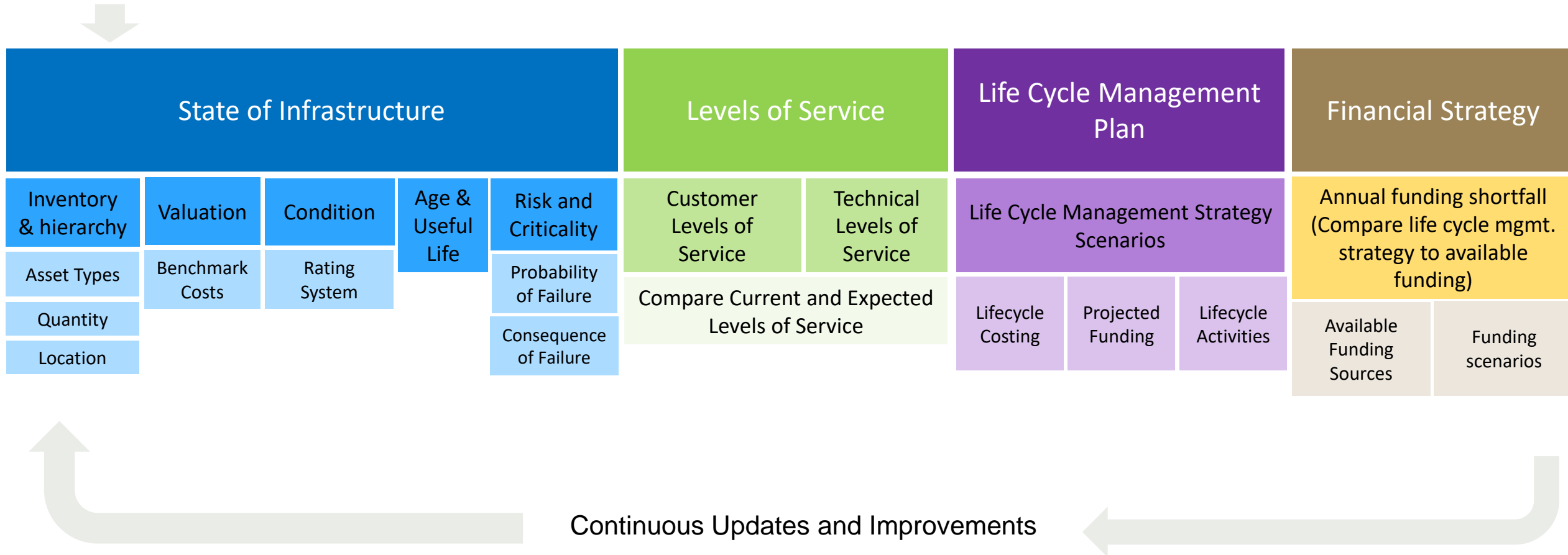
Definitions

“municipal infrastructure asset” means an infrastructure asset, **including a green infrastructure asset**, directly owned by a municipality or included on the consolidated financial statements of a municipality, but does not include an infrastructure asset that is managed by a joint municipal water board

“**green infrastructure asset**” means an infrastructure asset consisting of natural or human-made elements that provide ecological and hydrological functions and processes and includes natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs

Identify the green infrastructure assets for which you are responsible (do you own or maintain it?)

Green Infrastructure Asset Management Planning



Benefits of Incorporating Green Infrastructure into AMP



Increase priority of green infrastructure relative to grey



Understand priorities, risks and management options



Support strategic management to enhance green infrastructure



Defend budgets



Eligibility for federal and provincial infrastructure funding

Differences between Traditional Assets and Green Infrastructure Assets

Traditional Assets

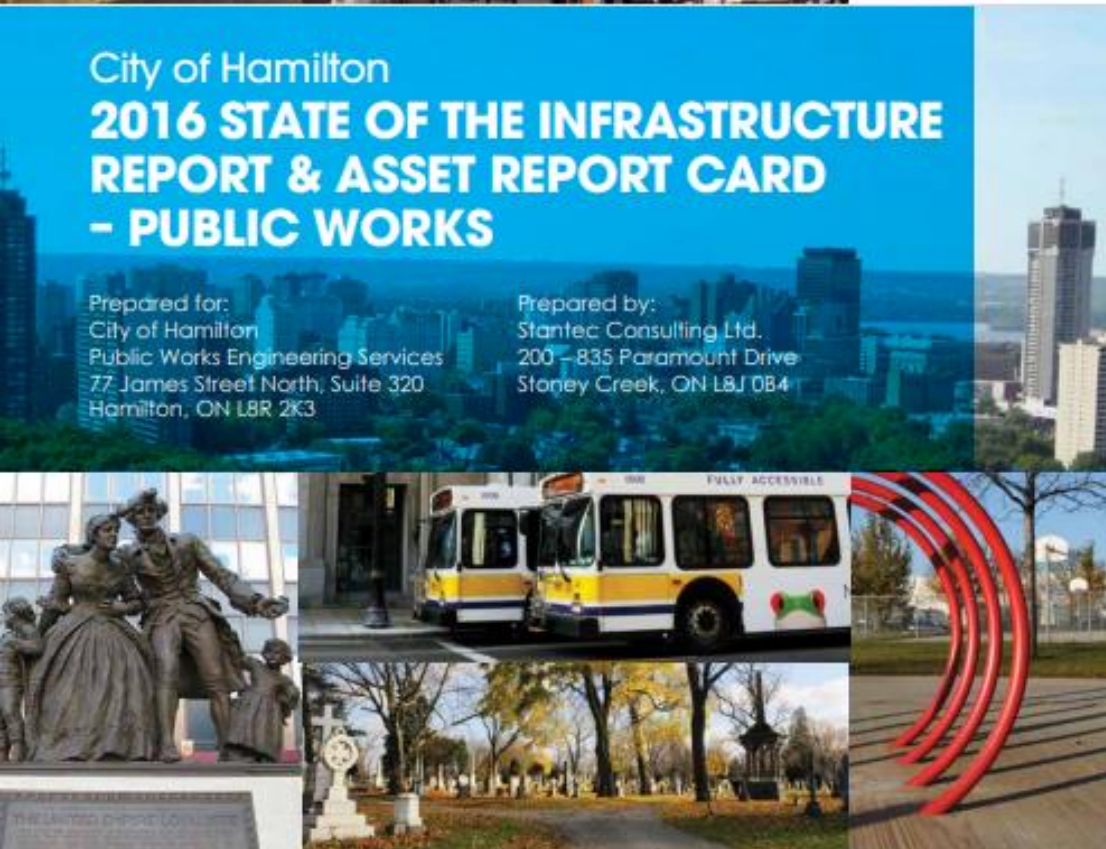
1. Must be constructed or bought
2. Have an end of life and must be replaced
3. Provides one or two services
4. Expected service levels achieved after construction/installation

Green Infrastructure Assets (some)

1. Naturally forming
2. They have no end of life – don't need replacement
3. Many services provided
4. Desired service capacity can take months, years, or decades to achieve



State of Infrastructure



Where municipalities answer the following questions:

- What assets are you responsible for?
- What are they worth?
- How old are they?
- What is their condition?

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What assets are you responsible for?

Example – City of London

Section 6: Wastewater - Stormwater

Asset Type	Asset
Stormwater Management	Open Conveyance (Municipal Drains, Drains, Channels, Dyke)
	Storm Water Management Facilities (Wet Facility, Dry Facility, Dissipation Pools, Online Flood & Erosion Control Facilities)
	SWM Green Infrastructure (Bioretention cells with or without underdrain, Drywells)
	Minor Treatment (Oil/Grit Separators)



Section 12: Urban Forestry

Asset Type	Asset
Street trees	Street trees within road allowance
Manicured park trees	Trees in manicured portions of parks (1566 hectares)
Woodlands Trees	Trees in woodlands or wooded portions of parks (1203 hectares)

Example – York Region

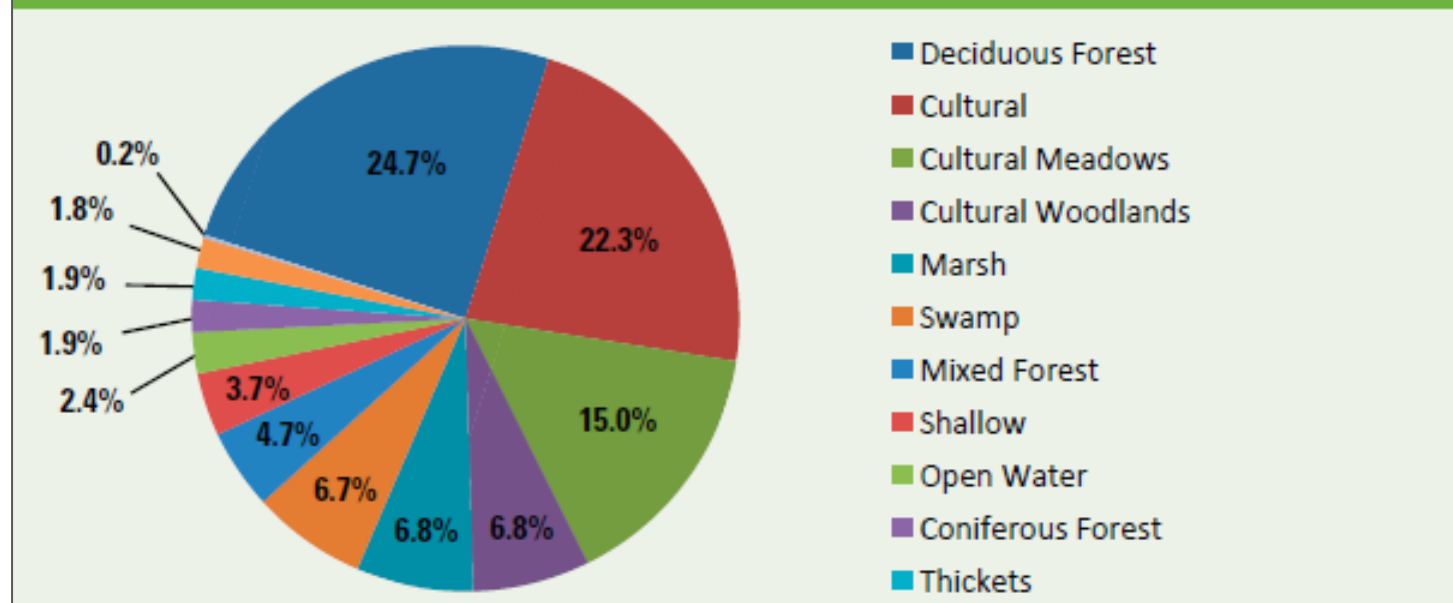
Environmental Services	Energy Management	Solar arrays and associated equipment.
	Forestry	The urban forest including street trees, growing medium and planters, the York Regional Forest including trails and structures ponds and drainage, and a forestry stewardship centre including outbuildings.
	Waste Management	A materials recovery facility including process equipment, transfer stations, household hazardous waste depots, community environmental centres, facilities, and co-ownership of an energy from waste facility.
	Wastewater CORE ASSET	Water resource recovery facilities, a wastewater treatment lagoon, equalization tanks, odour control facilities, wastewater pumping stations, sanitary forcemains, trunk sewers, maintenace holes and chambers.
	Water CORE ASSET	Water treatment plants, groundwater wells, elevated tanks, pumping stations, storage reservoirs, transmission mains, water chambers and maintenance holes.



Example – Richmond Hill

Table 18: Environmental Assets Inventory and Current Value			
Asset Class	Replacement Cost (2014 dollars)	Quantity	Data Confidence
Street Trees	\$13.4 M	43,217 trees	Intermediate
Natural Areas - Forest	\$74.2 M	696.2 hectares	Intermediate

Figure 38: Vegetation Communities in Richmond Hill's Natural Areas



Example – City of Hamilton (State of Infrastructure)

PARKS AND OPEN SPACES

Asset Type	Asset Component	2009 Inventory	2016 Inventory	Change	% Change
Parks ¹	Citywide	3,100 acres	1,160 acres	-287 acres	-9.3%
	Community		871 acres		
	Neighbourhood		708 acres		
	Parkette (acres)		73 acres		
	Urban Plaza ²	-	-	-	-
Open Spaces	Natural Open Space	1,690 acres	2,020 acres	1,019 acres	30%
	General Open Space		689 acres		

FORESTRY AND HORTICULTURE

Asset Type	Asset Component	2009 Inventory	2016 Inventory	Change	% Change
Urban Forest	Road Allowance (trees) ²	181,900	201,305	19,405	11%
	Urban and Rural Parks (trees)	64,200	68,468	4,268	6.6%
Rural Forest	Road Allowance (trees) ²	107,000	103,545	-3,455	-3.2%
	Natural Areas (trees)	535,000	547,650	12,650	2.4%
Horticultural Features	Road Allowance (floral) ²	449	372	-77	-17%
	Parks Shrub Beds (floral) ³	599	28,862	-	-
	Parks Annual Beds (floral) ³	-	2,818	-	-

Example – City of Newcastle, Australia

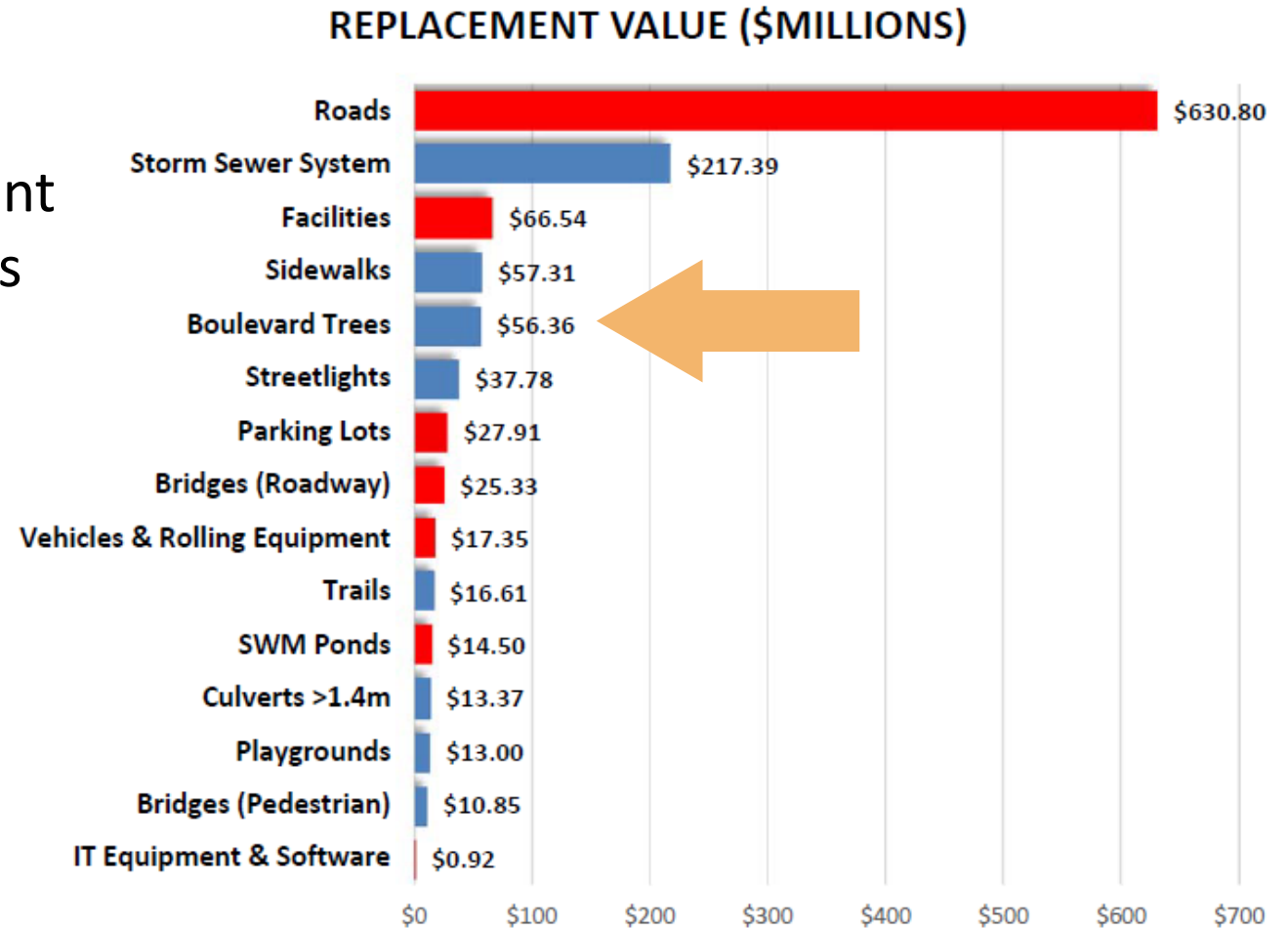
Service Output	Asset Stock	
Aquatic Centres	5 Aquatic Centres 2 Ocean Bath Facilities	
Arts and Cultural Facilities	1 Museum Facility including collections 1 Art Gallery Facility including collections 1 City Hall Facility 1 Civic Theatre Facility	1 Fort Exhibition Facility 1 Historic Fort 147 Public Art, Fountains and Monuments
Bushland, Watercourses and Public Trees	88 Bushland Parcels totaling 4.8Mill sqm 97,428 Street and Park Trees 607 Creek Reaches totaling 79km	42 Inland Clifflines totaling 20,444 sqm 45,269m of tracks and trails 106 Nest Boxes
Car Parking	1 Parking Station	108 Off Street Carparks
Caravan Park	1 Holiday Park	
Cemeteries	3 Cemeteries	
Child Care	11 Child Care Centres	
Coastal, Estuary and Wetland	12 Beaches (6 Main) 4.5 km Dunes 3 Lifeguard Facilities 3 Boat ramps	63 Wetlands covering 187ha 21 Coastal cliffines totalling 3.6km 29 sea and river walls totalling 1.1km 9 Rock platforms totalling 3.3km
Community Buildings	3 Senior Citizen Facilities 9 Community Centres 7 Community Halls	8 Surf Clubs 1 Neighbourhood Centre 7 Scout/Guide Halls
Libraries	9 Library Facilities including collections	
Parks and Recreational Facilities	54 Sporting Amenities Facilities 116 Playgrounds 15 Grandstands 18 Kiosks 15 Animal Enclosures 115 Shade and Shelter Structures	8 Skate facilities 65 Support Buildings e.g. clubhouses and sheds Support structures e.g. fencing, flagpoles, scoreboards, lighting
Public Amenity	39 Public Toilet Facilities	

What are they worth?

How Asset Value is Used

- Informs long-term asset management and financial management decisions
- Internal and external reporting
- Allows for **comparison** between service areas and asset categories

Why green infrastructure assets need to use the same method



General Valuation Approaches

Historical cost

The original cost to purchase or construct the asset

Current cost

The cost of the asset in today's dollars



Current Replacement Cost

Costs of replacing an existing asset with a new asset that will provide the **current required level of service** in the same operating environment. It should also consider changes in technology and construction methods and materials and use the least cost option.

Applying the Replacement Cost Method to Green Infrastructure

- Use a benchmark cost (\$/unit)
- Total quantity of asset: area, length, number

Replacement cost = Benchmark cost x Quantity

General replacement cost approach

- Engineered assets: Construction costs
- Natural assets: Restoration costs

PSAB 3150 vs. Asset Management Plan Valuation

PSAB 3150

Public Sector Accounting Board Handbook, Section 3150 – Tangible Capital Assets (TCAs)

- Valuation of assets for financial statements
- TCAs = historical cost of asset minus accumulated depreciation/amortization
- Restricts the inclusion of natural assets as TCAs

Asset Value for Asset Management Planning

- Current replacement cost, used for financial planning
- Should include any asset with a role in service delivery and requires deliberate management, whether they are TCAs under PSAB 3150 or not.

Asset Management Plan Valuation vs. Ecosystem Service Valuation

Ecosystem services valuation

- Economic Valuation
- Useful for making a business case for protecting and managing green infrastructure
- Does not align with the valuation method used for traditional assets

Asset value for asset management planning

- Current replacement cost
- Asset focused
- Consistent across all assets in an asset management plan

How old are they?



Age-Related Attributes

➤ Age-related attributes can act as a surrogate for condition & indicate when rehabilitation or replacement may be required.

➤ Attributes:

- Age
- Expected useful life
- Remaining useful life

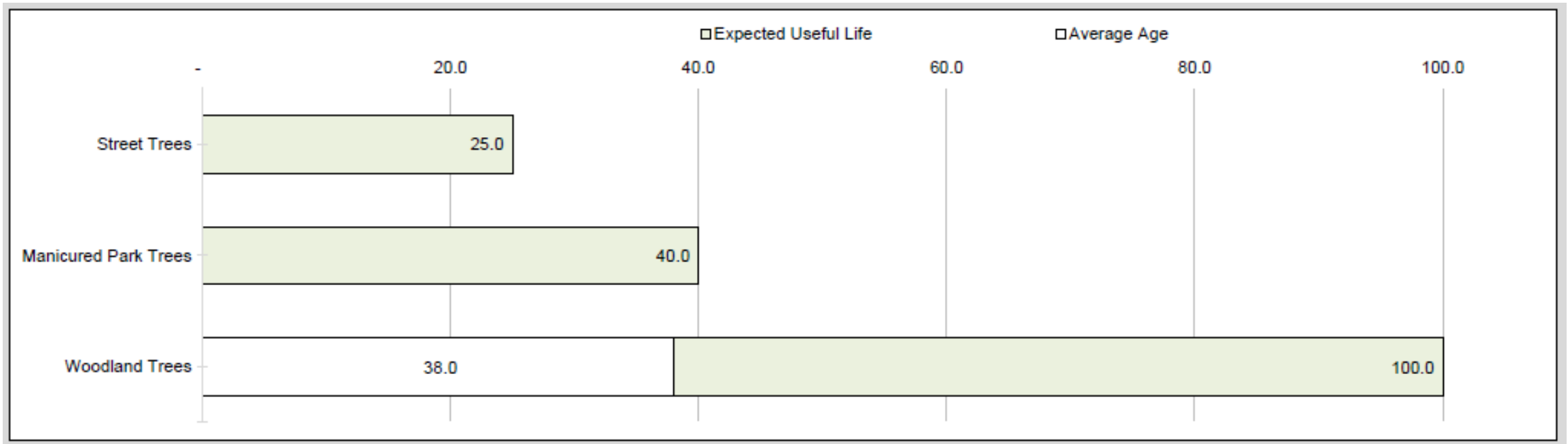
➤ For each asset category report:

- average age or age as a proportion of expected useful life
- proportion of assets within each age class

Asset Useful Life

Asset Group	Asset Type	Asset Sub-Type	Asset Useful Life
URBAN FOREST			
Biological Assets	Street Trees	Urban Trees	35 years
		Suburban Trees	44 years
		Rural Trees	53 years
	Plants	Shrubs	Not applicable – entire bed replaced when street trees are replaced (individual failed plants are considered a maintenance cost)
		Perennials	
	Growing Medium	Soil Cells	50 years (when sidewalk is replaced)
		Boulevard Soil Trench	Not applicable – made up of native soils
		Engineered Growing Medium	35 years
		Native Soils	Not applicable

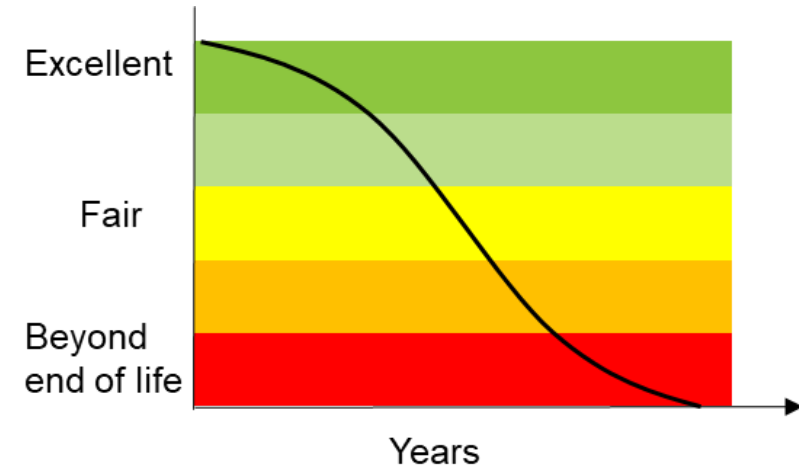
Average Age & Average Remaining Life



What is their condition?

Condition Attributes

- Attributes which measure physical condition
- Report: average condition and condition profile for asset group or category



York Region GI AMP 2017: Condition Criteria for Street Trees

Grade		1 / A	2 / B	3 / C	4 / D	5 / E
Condition		Very Good	Good	Fair	Poor	Very Poor
LoS		Conforming Level	Conforming Level	Observation Level	Intervention Level	Non-Conforming
STREET TREES	Status	Thriving	Satisfactory	Potential Trouble	Declining	End of Life
	Health	Perfect specimen with excellent form and vigor, well-balanced crown. Likely to exceed life expectancy.	Imperfect canopy density in 10% of tree, Less than half normal growth rate; pest damage controllable. Typical life expectancy.	Crown decline and dieback up to 30% of the canopy. Obvious signs of pest problems. Below average life expectancy.	Significant dieback affecting larger branches. Stunting obvious with obvious pest problems. Life expectancy is low.	Will likely die within 5 years.
	Management	Implement routine maintenance	Implement routine maintenance	Requires corrective pruning	Requires major corrective pruning, or replacement	Will require replacement or removal

Channel in very
poor condition

High risk

Requires renewal



Channel Before Restoration work



Channel After Restoration work

Channel in good
condition following
renewal

Low risk

Example from City of London CAMP 2019

Example from TRCA restoration of shoreline at Frenchman's Bay, Pickering

Poor condition, low levels of service



Good condition, high levels of service following investment in restoration



Frenchman's Bay shoreline before (left) and after (right) restoration, 2014-2015.

Condition Profile

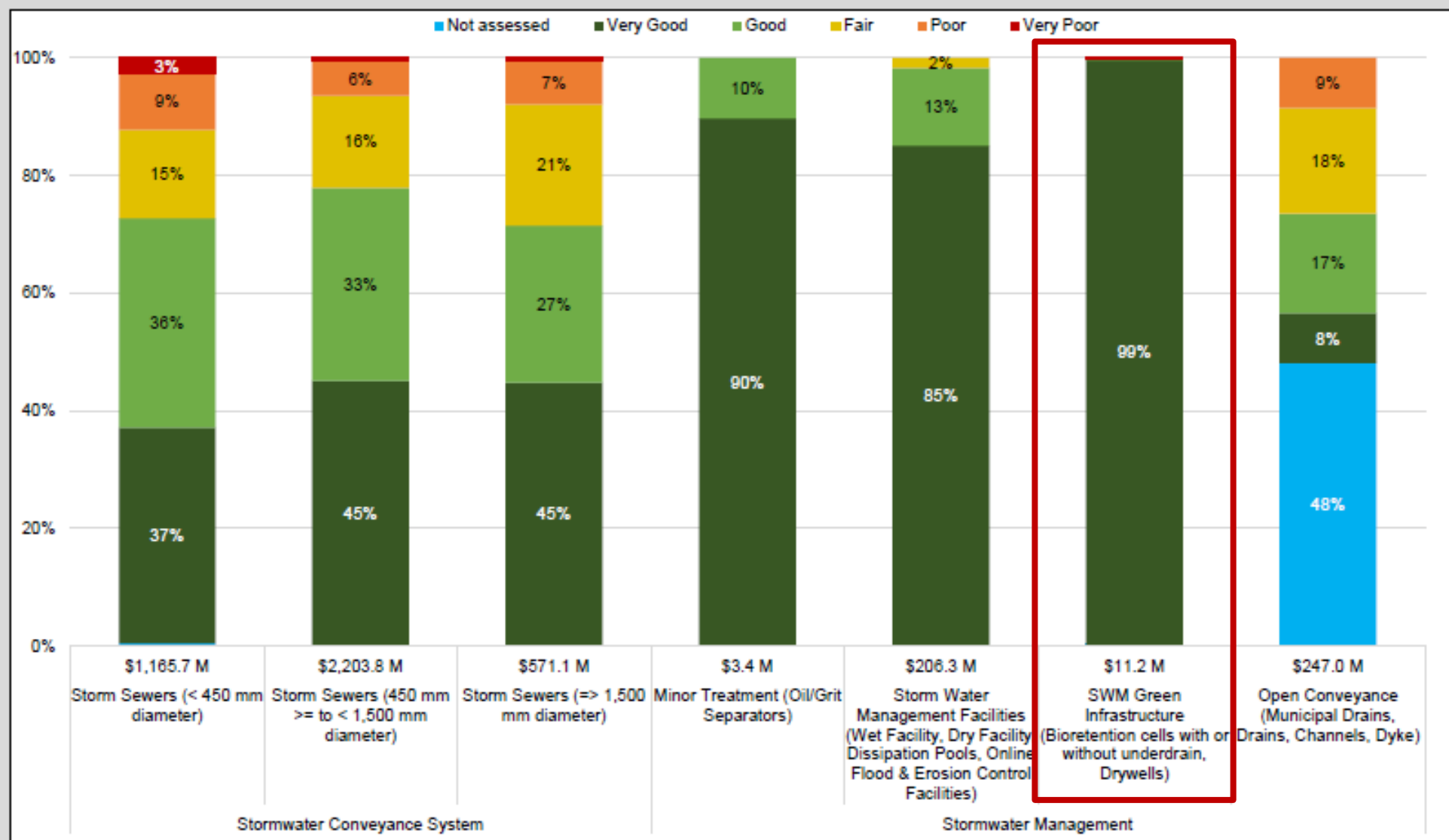
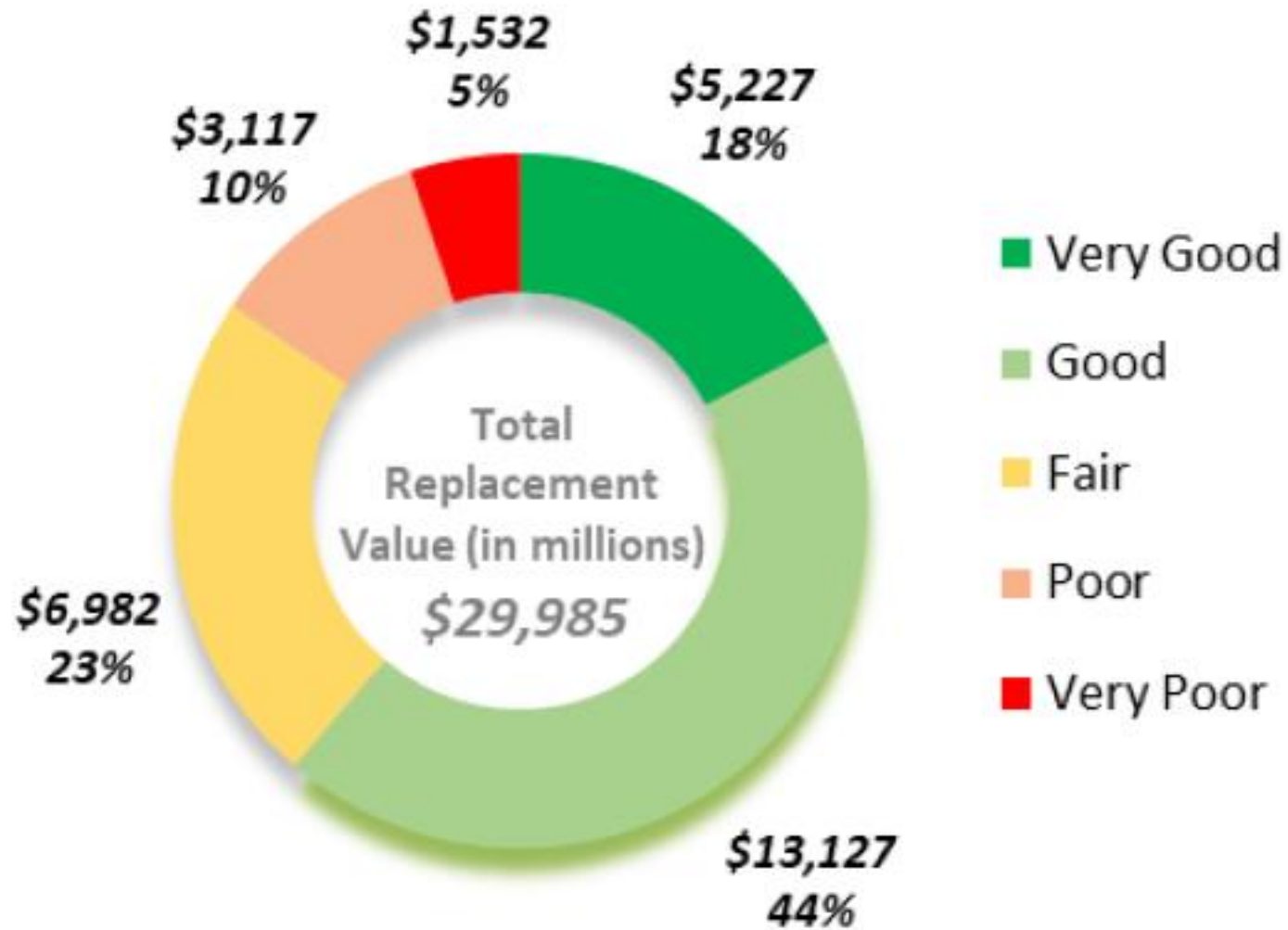


Figure 6.3 Asset Condition Detail (Wastewater – Stormwater Services)

Value-Condition Example



Winnipeg, 2018

PAUSE: QUESTIONS?

Stage 2: Levels of Service

Levels of Service Analysis

A measure of the quality, quantity, and/or reliability of a service from the perspective of the public

Must answer the following questions:

- 1) What types of services are provided by assets?
- 2) Who receives these services?
- 3) What level of service is currently being delivered (performance)?
- 4) What level of service are we aiming for (target)?

Example: Levels of Service

Community Level of Service	Service Attribute	Technical Level of Service	Technical Performance Measure	Planned Target	Reported 2016
Will street trees & landscaping provide expected benefits to residents?	Scope	% of available space along urban Regional roads occupied by street trees.	% of urban Regional roads meeting applicable landscaping standards.	95%	75%
	Quality	Health of street tree and landscape plantings as a measure of aesthetics and performance of supporting assets (e.g. growing media and irrigation systems).	Tree health condition (% of street trees meeting satisfactory or better health rating).	90%	84%

Example: Levels of Service

Table 12.2 (Continued) Levels of Service Metrics – Foundational and Advanced (Urban Forestry Services)

Performance Measure

Customer / Council Focused

1

2

Technical Focused

1

2

CUSTOMER VALUE	CORPORATE LOS OBJECTIVE	CUSTOMER LOS MEASURE	CUSTOMER LOS PERFORMANCE
Quality	Providing Street Trees in acceptable condition	% City-owned Street Trees and Trees in Manicured Park Tree in fair or above condition	96%
	Providing Urban Forestry at the right design standard	% of Woodland Tree level of service quality rating in fair or above condition	52%
		Average Woodland Tree level of service quality rating (Rating of 1 is 'Very Good', 2 is 'Good', 3 is 'Fair', 4 is 'Poor', 5 is 'Very Poor')	2.89

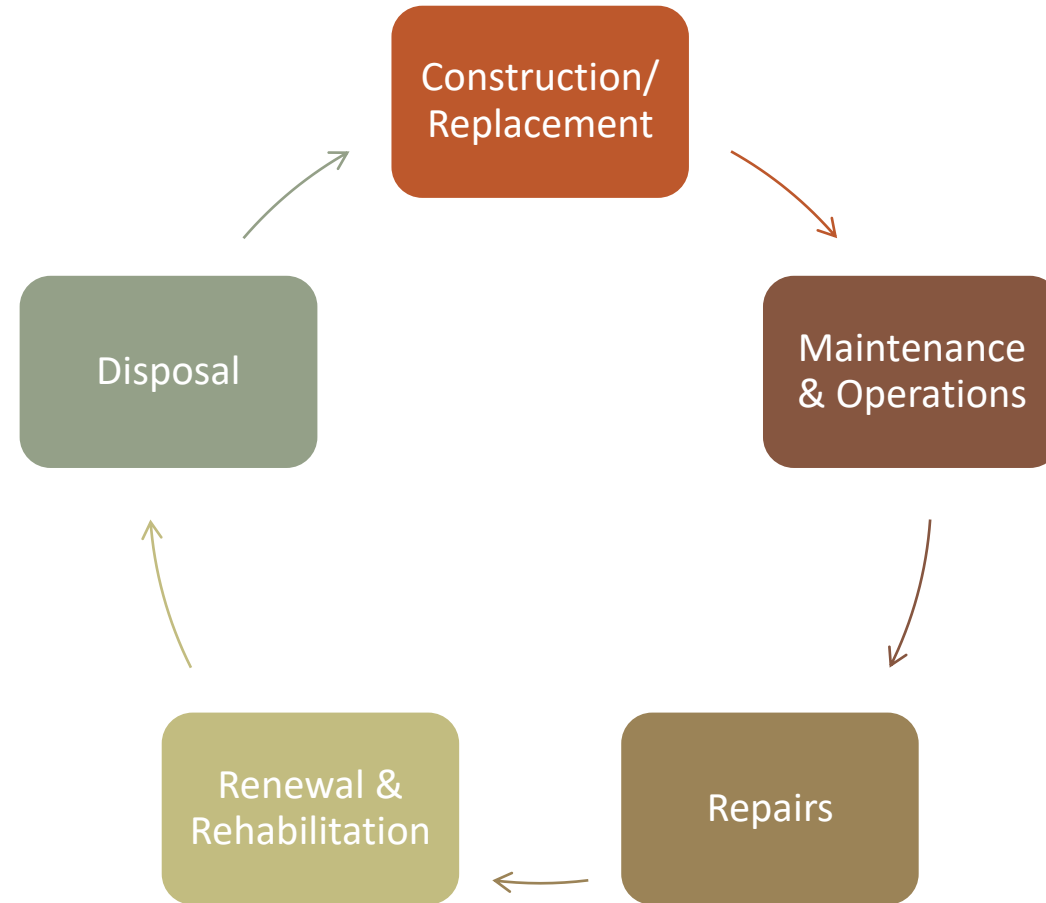
City of London's Corporate AMP 2019

Stages 3 & 4:

Lifecycle Management Strategy &
Financial Strategy

Lifecycle Management Strategy

The set of **planned actions** that will enable the assets to *provide desired levels of service* at the **lowest lifecycle cost**, while **managing risk**



Example: Life Cycle Management Strategy

Activities <i>Activities that will enable the assets to provide the current levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost</i>	Specific Asset Management Practices or Planned Actions
Renewal/Rehab Activities Significant repairs designed to extend the life of the asset.	<p><i>Street Trees, Manicured Park Trees</i></p> <ul style="list-style-type: none"> • Certain activities can be performed to extend lives of mature and veteran heritage trees that have suffered from compaction by footsteps: <ul style="list-style-type: none"> ○ Deep root fertigation. ○ Propping and cabling. ○ Mycorrhizal inoculation. ○ Root barriers/deflectors can be retroactively installed in certain instances. <p><i>Woodland Trees</i></p> <ul style="list-style-type: none"> • Rehabilitating a tree may not be a practical or relevant activity – typically a tree is either maintained or replaced.
Replacement/Construction Activities Activities that are expected to occur once an asset has reached the end of its useful life and renewal/rehab is no longer an option.	<p><i>Street Trees, Manicured Park Trees</i></p> <ul style="list-style-type: none"> • Planned plantings for non-Woodland trees. • Use of underground technologies to provide protected rooting zones in conjunction with utilities, sidewalks, and, in some technologies, roads. <p><i>Woodland Trees</i></p> <ul style="list-style-type: none"> • There are no planned plantings for Woodland trees.

City of London 2019

Financial Strategy

Funding Sources

Identify sources of funding such as taxes, government transfers, user fees and debt

Funding Gap

Identify funding and infrastructure gap

Funding Approach

Provide an approach for funding proposed asset life cycle strategy

Example: Infrastructure Gap

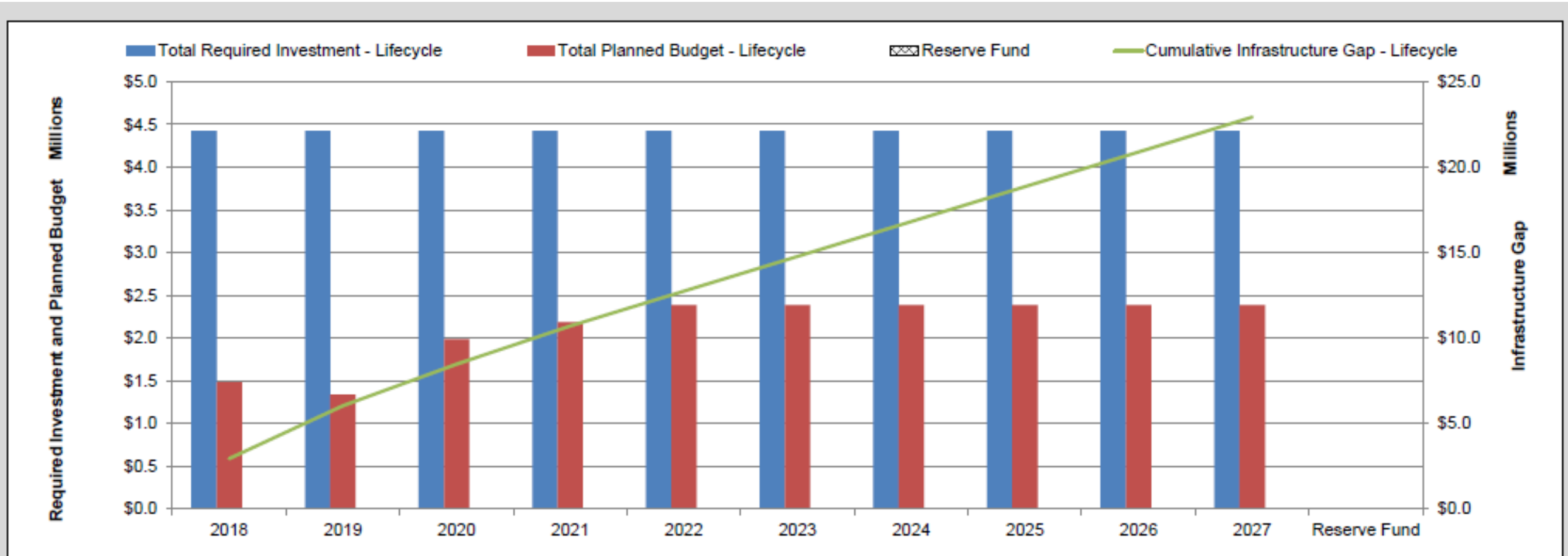


Figure 12.5 Forecasted Lifecycle Infrastructure Gap (Urban Forestry Services)

City of London Corporate AMP (2019)

Green Infrastructure Asset Management Planning Maturity Spectrum

Unaware	Aware	Beginner	Intermediate	Advanced
The organization has not recognized the need for green infrastructure asset management or is unaware of the need	<p>The organization has recognized the need for green infrastructure asset management and there is evidence of intent to advance it</p> <p>Basic asset information is recorded on some green infrastructure assets, but it is in a combination of sources and formats. Often this information is collected for other purposes (e.g. design, maintenance, inspections) rather than asset management</p>	<p>Basic information (e.g. type, quantity, age) is recorded on green infrastructure assets in an asset register that enables hierarchical reporting</p> <p>Placeholders for green infrastructure are included in an asset management plan</p> <p>High-level green infrastructure risk/criticality assessments use broad categories to assess risks and are based on staff judgement</p>	<p>Green infrastructure is included in an asset management policy or strategy</p> <p>At least one green infrastructure asset is included in an asset management plan</p> <p>Detailed information (e.g. condition) is recorded on some green infrastructure assets in an asset register</p> <p>Some high-level green infrastructure risk/criticality assessments are based on analytics (e.g. utilize condition data)</p>	<p>All green infrastructure assets are included in an asset management plan</p> <p>Detailed information is recorded for all green infrastructure assets in an asset register</p> <p>Detailed green infrastructure risk/criticality assessments are based on probability and consequence of failure and analytics that utilize asset data</p> <p>A lifecycle strategy plans actions (e.g. maintenance, rehabilitation, replacement) based on the total cost of the green infrastructure assets throughout their life.</p>

Conclusions

- Green infrastructure assets need to be included in asset management plans by July 1, 2023 (*O. Reg. 588/17*)
- Assets do NOT need to be Tangible Capital Assets (TCAs) to be included in asset management plans
- Asset valuation should be calculated using current replacement cost
- There are differences between green and traditional infrastructure, but there are strategies for addressing those differences.
- All the data isn't required before you can start to integrate green infrastructure assets into asset management plans.

Questions